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# TECHNICAL DATA ON APPROVED COATINGS SYSTEMS DESIGNATED SOURCES LIST DS:113

MATERIALS INFORMATION

ENGINEERING MATERIALS OFFICE

# TECHNICAL DATA

# ON

# APPROVED COATINGS SYSTEMS

# DESIGNATED SOURCES LIST DS: 113

by

R.Y. Fujii

and

R.A. Sterk

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CHEMICALS SECTION

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## Introduction

One of the recommendations of the Task Force on Procedures for Structural Maintenance and Rehabilitation was that a Designated Sources List be established for Ministry approved structural coating systems. This has been done and there are, currently, four approved coating systems listed in DS:113.

This Materials Information report lists the technical data of the currently approved coating systems for existing structural steel and, where applicable, the relevant specifications. The technical data covers such items as surface preparation requirements, paint characteristics like compability, application methods, viscosity, drying time etc., and safety precautions.

The Engineering Materials Office has a mandate to investigate promising coating systems on an "ongoing" basis and it is, therefore, conceivable that the current listing of approved coating systems will expand in time with additional approved coating systems. The relevant DS listing and Materials Information report of technical data will then be updated accordingly.

## 1. DS 113.1 COATING SYSTEM 1 - HIGH BUILD ALKYD

This system is for coating of existing structural steel that has been partially or totally cleaned in accordance with the SSPC SP7 surface preparation specification for condition category A and SSPC SP6 for condition category B as defined in Form 911.

Coating System 1 is a high build alkyd system consisting of the following:

(a) MTC Form 1705 Yellow zinc chromate primer
- Composition type (approx. 50% solids by volume)
- Contains small amount of lead driers (< 1%)

(b) MTC Form 1704 Grey 501-107 or green 503-127 finish coat
- Composition type (approx. 50% solids by volume)
- Green finish coat for handrail contains lead chromate pigment (approx. 5% of finish coat)

Over condition category A: Two-coat system consisting of one primer coat and one finish coat.

Over condition category B: Three-coat system consisting of two primer coats and one finish coat.

General Data

(a) Cleaning Requirement

The cleaning requirements normally specified for coating System 1 are:

SSPC SP6 Commercial Blast Cleaning.
SSPC SP7 Brush-Off Blast Cleaning.

(b) Compatibility

Coating System 1 is generally compatible with oil base, alkyd, or oleoresinous systems previously applied on structural steel. Spot tests may be necessary to confirm compatibility of the old and new systems particularly if the composition of the original system is unknown. Coatings that curl or lift after application of the primer coat should be removed and the area recoated.

(c) Application Methods

The primer and finish coat can be applied by brush, roller or spray over blast cleaned steel or over sound existing coating.

(d) Application Conditions

The factors affecting application of Coating System 1 shall be in accordance with the requirements of SSPC-PA1, Section 6, which states that coating shall not be applied when the temperature of the steel, coating, or air is below $4^{0}C$ and when the steel surface temperature is less than $3^{0}C$ above the dew point.

(e) Viscosity

Both the primer and finish coat have high viscosity and are thixotropic that is, the high viscosity of the coating reduces with increasing rate of shear (mixing) and returns to its original state when shearing action ceases.

(f) Dry Film Thickness

| | |
|---|---|
| Prime No. 1 | 75 µm minimum |
| Prime No. 2 | 75 µm minimum |
| Finish Coat | 75 µm minimum |

(g) Recoat Time

Overnight between coats ( 16 to 24 hours ).

(h) Theoretical Coverage
( at 75 µm dry film )

6.5 $m^2/L$ (320 $ft.^2/gal.$) for primer and finish coat.

(i) Practical Coverage
( at 75 µm dry film )

3.3 to 3.6 $m^2/L$ (160 to 175 $ft.^2/gal.$) over through truss or lattice work.

(j) Approximate Useful Life Of Coating System 1

8 to 10 years. Estimate is based on the performance of the two-coat system applied on SSPC SP10 near white blast cleaned steel panels.

(k) Safety Precautions

The high build alkyd system contains volatile, flammable organic solvents and lead chromate pigment in the green handrail finish coat. Because of their flammability and potential toxicity, proper safety precautions should be observed to protect against these hazards. The coating manufacturer's recommended safety precautions for each of the products should be followed. A general guide to safety in coating application can also be found in SSPC-PA Guide 3.

## 2. US 113.2 COATING SYSTEM 2 - INORGANIC ZINC - VINYL

This system is for coating of existing structural steel which has been totally cleaned in accordance with the SSPC SP10 surface preparation specification. This system is not intended for application over old coating or over rusted steel surfaces.

Coating System 2 is a lead-free, four-coat inorganic zinc-vinyl coating system consisting of the following Canadian General Standards Board (CGSB) or proprietary specification components:

(a) CGSB 1-GP-171 Inorganic Zinc, Type 1 Primer (Prime Coat)

- A two-component, self-curing, zinc rich primer of approximately 65% solids by volume of mixture, and which has a limited pot life of about 8 hours after mixing of the components at $25^{0}C$.

- Should be applied in accordance with manufacturer's instructions.

- Overnight drying is recommended prior to topcoating with the tie coat (second coat) at $16^{0}$ to $25^{0}C$. Longer curing time of 7 days is required at $-18^{0}C$.

- Theoretical coverage at 65 µm dry film thickness is 9.2 to 10.2 $m^2/L$ (450 to 500 $ft.^2/gal.$)

(b) CGSB 1-GP-121 Vinyl Wash Primer (Second Coat)

- A two-component pretreatment composed of a vinyl resin base and an acid catalyst of approximately 10% solids by volume of mixture. It has a limited pot life of 8 hours after mixing of the components at $25^{0}C$.

- After spray application over zinc primer, the wash primer must be topcoated within 1 to 8 hours because it is moisture sensitive.

- Theoretical coverage at 6 µm dry film thickness is about 16.4 $m^2/L$ (800 $ft.^2/gal.$).

or Proprietary Tie Coat (Second Coat)

- A manufacturer's own formulation or a reduced and tinted vinyl finish coat of about 10-15% solids by volume.

- Generally a single package with no pot life limitation and should be applied in accordance with manufacturer's instructions.

- Theoretical coverage at 25 µm dry film thickness is about 6.1 to 8.2 $m^2/L$ (300 to 400 $ft.^2/gal.$) dependent on the proprietary product.

(c) CGSB 1-GP-199 High Build Vinyl (Third Coat)

- A single package high build vinyl coating of approximately 30% solids by volume with no pot life restrictions.

- Should be applied in accordance with manufacturer's instructions.

- Recoat time varies from 2 to 6 hours dependent on the product and application temperatures.

- Theoretical coverage at 50 µm dry film thickness is about 5.3 to 6.6 $m^2/L$ (260 to 325 $ft.^2/gal.$) dependent on the product.

- Colour: Green 503-211

(d) CGSB 1-GP-199 High Build Vinyl (Fourth Coat)

- Same properties as for the third coat (c).

- Colours: Green 503-209
  Green 503-227
  Grey 501-107 (Semigloss equivalent)

General Data

(a) Cleaning Requirement

The cleaning requirement normally specified for Coating System 2 is:

SSPC SP10 Near White Blast Cleaning.

(b) Compatibility

Coating System 2 is incompatible with organic coatings as well as rusted steel surfaces. The coating system must be applied over blast cleaned steel as defined above in (a) Cleaning Requirement.

(c) Application Method

The usual method of application of all four components of Coating System 2 is by spraying.

(d) Application Conditions

The factors affecting application of Coating System 2 shall be in accordance with the requirements of SSPC-PA 1, Section 6 (minimum steel, coating or air temperature is $4^{0}C$ and the steel surface temperature must be $>3^{0}C$ above the dew point).

There are special coatings, such as inorganic zinc primer, which can be applied at temperatures below $0^{0}C$. These coatings should be applied strictly according to manufacturer's instructions. Generally, surface temperature must be at least $3^{0}C$ above the dew point and the surface must be free of ice, conditions which may be difficult to determine at freezing temperatures.

Likewise, for the tie coat, and finish coats, manufacturer's application instructions should be followed.

Generally, proprietary and wash primer type tie coats should not be applied at surface and air temperatures below $4^{0}C$. The vinyl finish coats may gel at temperatures below freezing which may cause difficulty in spray application. One manufacturer (Mobil) does not recommend thinning to reduce viscosity at low temperatures; rather, the product should be warmed to revert to normal viscosity.

(3) Dry Film Thickness

| | | With Vinyl Wash Tie Coat (µm) | With Proprietary Tie Coat (µm) |
|---|---|---|---|
| 1-GP-171 | Inorganic Zinc Prime Coat | 65 - 75 | 65 - 75 |
| Tie Coat | ( 2nd coat ) | 6 - 15 | 25 - 40 |
| 1-GP-199 | Vinyl ( 3rd coat ) | 65 - 90 | 50 - 65 |
| 1-GP-199 | Vinyl ( 4th coat ) | 64 - 100 | 60 - 100 |
| | | 200 - 280 | 200 - 280 |

When dry film thickness is determined by means of a pull-off type magnetic gage such as Mikrotest or Inspector, the blank reading over the blast cleaned steel usually measuring about 12 µm, should be subtracted from the total dry film thickness measurement for actual coating thickness.

(f) Approximate Useful Life of Coating System 2

About 20 years. Estimate is based on the performance of the coating system applied on SSPC SP10 near white blast cleaned steel panels.

(g) Safety Precautions

Manufacturer's precautionary information and warnings should be observed for each of the coating system components. Proper protective devices such as goggles, face shields, gloves, etc. should be worn to prevent burns when handling a two-component coating, especially the liquid silicate component of the inorganic zinc primer and the acid (catalyst) component of the vinyl wash tie coat. The vinyl finish coats contain volatile, flammable organic solvents so that the safety precautions recommended by the manufacturer should be followed because of the flammability and potential toxicity of the coating components. A general guide to safety in coating application can also be found in SSPC-PA Guide 3.

## 3. DS 113.21.1 COATING SYSTEM 21.1, PROPRIETARY PRODUCTS-EPOXYMASTIC

This two-component coating is for coating of existing structural steel which has been at least power tool cleaned in accordance with SSPC SP3 surface preparation specification to remove loose rust, loose coating and scale in mild environments. For more severely corroded surfaces or for more severe environments, dry abrasive blast cleaning to SSPC SP7 brushoff blast is recommended. According to SSPC, SP3 surface preparation is more costly than SP7. The coating applied as a single coat has good adhesion to tightly adhering rust as well as to weathered or deteriorated coatings.

Coating System 21.1 is a lead-free two-component, high solids, aluminum coloured, modified epoxy mastic coating. It has 90% solids by volume of mixture with a limited pot life of about 4 hours at $24^{0}C$ (less at higher temperatures) after mixing of the two components. According to the manufacturer, this coating (Carbomastic 15) may discolour (bronze) on the surface under certain application conditions such as presence of moisture on the steel or coating surface, or when the mixed material is nearing the end of its pot life.

Colour: Aluminum

### General Data

(a) Cleaning Requirement

The following are the cleaning requirements normally specified for Coating System 21.1. Best results are obtained over blast cleaned steel surfaces:

SSPC SP3 Power Tool Cleaning.
SSPC SP7 Brush-Off Blast Cleaning.

(b) Compatibility

Coating System 21.1 may be applied over most generic coatings which are in sound conditions, tightly adhering and suitable for topcoating. A test patch over existing coatings is recommended if there is concern over compatibility.

Although no topcoat is normally required for Coating System 21.1, it may be overcoated with certain coatings particularly in more aggressive exposures. The manufacturer's specific recommendations should be followed if a topcoat is required.

(c) Application Methods

Conventional or airless spray application is the method recommended by the manufacturer. Small areas may be brushed.

(d) Application Conditions

The minimum application temperature recommended by the manufacturer of Coating System 21.1 is $10^{0}C$ for maximum performance. The steel surface temperature must be $>3^{0}C$ above the dew point. Below $5^{0}C$, the coating may not cure adequately.

(e) Dry Film Thickness

150 - 225 µm minimum, the latter for severe exposure areas (over condition category B).

(f) Recoat Time
(between coats)

24 hours at $24^{0}C$
4 days at $10^{0}C$

(g) Theoretical Coverage

5.9 $m^2/L$ (290 $ft.^2/gal.$) at 150 µm dry film thickness.

(h) Approximate Useful Life of Coating System 21.1

10 to 15 years. Estimate is based on the Coating System 21.1 applied on SSPC SP10 near white blast cleaned panels and on lightly rusted steel panels exposed to salt spray and accelerated weathering tests.

(i) Safety Precautions

The manufacturer's recommendations should be followed. Generally the product contains flammable solvents and harmful vapours which may possibly cause irritation, allergic, respiratory and skin reactions. The use of proper respirators, protective goggles, gloves, skin creams, etc. is recommended by the manufacturer especially when handling the catalyst. A general guide to safety in coating application can also be found in SSPC-PA Guide 3.

## 4. DS 113.21.2 COATING SYSTEM 21.2 PROPRIETARY PRODUCTS - WATERBASE ACRYLIC LATEX

This system is for coating of existing structural steel which has been partially or totally cleaned in accordance with SSPC SP7 surface preparation specification for condition category A and SSPS SP6 for condition category B as defined in Form 911. It is an alternative coating system to DS 113.1 Coating System 1 with comparable durability, but being nonflammable and less toxic. It is not recommended for use over steel surfaces which are not completely free of rust.

Coating System 21.2 is a water soluble, three-coat acrylic latex coating system consisting of a lead-free red primer, a lead-free white midcoat, and a grey or green finish coat. The green finish coat (for handrails) contains about 10% lead chromate pigment. All of these coatings are single package which eliminate pot life restrictions.

Approximate solids by volume: Primer 42%
Midcoat and Topcoat 36%

Finish Coat Colours: Green 503-209
Green 503-227
Grey 501-107 (Semigloss equivalent)

### General Data

(a) Cleaning Requirements

The cleaning requirements normally specified for Coating System 21.2 are:

SSPC SP6 Commercial Blast Cleaning.
SSPC SP7 Brush-Off Blast Cleaning.

(b) Compatibility

Coating System 21.2 is compatible with alkyd base systems previously applied on structural steel. Spot tests may be necessary to determine compatibility of the old and new systems if the composition of the previous system is unknown. Coating System 21.2 is not compatible with rust which causes excessive blistering of the applied coating and underfilm corrosion of the steel substrate.

(c) Application Methods

The coating system can be applied by brush, roller, and by airless and conventional spray. Thinning of the coatings with water may be required to achieve spraying viscosity for conventional spray at normal temperatures.

(d) Application Conditions

The factors affecting application of Coating System 21.2 shall be in accordance with the requirements of SSPC-PA 1, Section 6. Application at substrate temperatures below $10^{0}C$ should be avoided because improper film formation may occur resulting in poor corrosion resistance. Also at the upper limit, surface temperature should be below $32^{0}C$ for brush and roller applications and a maximum of $49^{0}C$ for spray application. Steel substrate may be damp, but excessive wetness caused by the surface being below the dew point, may cause sagging of the applied coating.

(e) Dry Film Thickness

| | |
|---|---|
| Primer | 65 µm minimum |
| Midcoat | 50 µm minimum |
| Finish Coat | 50 µm minimum |

(f) Recoat Time

2 to 4 hours between coats depending on temperature and humidity. The midcoat and finish coat dry more slowly than the primer.

(g) Theoretical Coverage

| | |
|---|---|
| Primer | 6.8 $m^2/L$ (333 $ft.^2/gal.$) @ 65 µm dry |
| White Midcoat | 7.3 $m^2/L$ (357 $ft.^2/gal.$) @ 50 µm dry |
| Finish Coat | 7.3 $m^2/L$ (357 $ft.^2/gal.$) @ 50 µm dry |

(h) Approximate Useful Life of Coating System 21.2

8 to 10 years. The useful life estimate is based on the testing of the coating system applied on SSPC SP10 near white blast cleaned steel panels.

(i) Safety Precautions

The manufacturer's recommendations should be followed. These coatings may contain ingredients which can cause irritation by excessive skin contact so that proper clothing and respirators should be used during spray application. Being water base coatings, there are no flammability hazards during application of Coating System 21.2. A general guide to safety in coating application can also be found in SSPC-PA Guide 3.

## NOTABLE FEATURES

Structural Steel Coatings

| System | Expected Life * | Remarks |
|---|---|---|
| System 2 (DS 113.2) Inorganic Zinc-Vinyl | about 20 years | (a) Most beneficial when applied as original system on a new bridge. Difficult and expensive to apply on exisiting bridges coated with other systems.<br><br>(b) Competitive designated sources material. |
| System 21.1 (DS 113.21.1) Epoxymastic | 10 to 15 years | Proprietary a) Aluminum colour only<br>b) Suitable for spot cleaning and coating<br>c) Currently one approved source and price is relatively fixed |
| System 1 (DS 113.1) High Build Alkyd | 8 to 10 years | (a) Economy has been established through 10 years use in MTC<br>(b) Suitable for spot cleaning and coating<br>(c) Competitive designated sources material |
| System 21.2 (DS 113.21.2) Acrylic Latex | 8 to 10 years | Proprietary a) Water base coating system<br>b) Currently one approved source and price is relative fixed |

* When applied in accordance with manufacturer's recommendations, favourable conditions.